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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

ANDREAS BACHER ET AL.

Serial No.: 10/618,936

Filed: July 14, 2003

For: SILANE-CONTAINING POLYVINYL ALCOHOL FOR COATING SLIPS

Attorney Docket No.: WAS 0595 PUS

Group Art Unit: 1714

Examiner: Vickey M. Ronesi

APPELLANTS' BRIEF UNDER 37 C.F.R. § 41.37

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Sir:

Appellants hereby appeal the rejection of claims 1-15, all the claims of the subject application. In the Office Action of November 23, 2005, the claims were rejected for the second time, and the rejection made final.

I. REAL PARTY IN INTEREST

The real party in interest is Wacker Polymer Systems GmbH & Co. KG, by assignment recorded at Reel/Frame 014283/0265.

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## **II. RELATED APPEALS AND INTERFERENCES**

Appellants are unaware of any appeals or interferences which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal

## **III. STATUS OF CLAIMS**

Claims 1-15 are pending in this application. Claims 1-15 have been rejected. Appellants appeal the rejection of all the claims, claims 1-15.

## **IV. STATUS OF AMENDMENTS**

No claim amendments have been made subsequent to the final rejection.

## **V. SUMMARY OF CLAIMED SUBJECT MATTER**

The claimed invention pertains to silane-containing polyvinyl alcohols which are hydrolyzed or partially hydrolyzed vinyl ester copolymers having a degree of hydrolysis of from 75-100 mol %, obtained by hydrolyzing a polymer prepared free radical polymerization of one or more vinyl ester monomers, of which 1-30 mol % are 1-alkylvinyl esters of C<sub>1-6</sub> carboxylic acids, where the alkyl groups of the 1-alkylvinyl moieties are C<sub>1-6</sub> alkyl groups; from 0.01 to 10 mol % of ethylenically unsaturated silane comonomers; and optionally further copolymerizable comonomers. Claim 1 as filed; Specification, p. 2, l. 23 to p. 3, l. 18.

## VI. GROUND S OF REJECTION TO BE REVIEWED ON APPEAL

The sole rejection, from which appeal is taken, is the rejection of claims 1-15 under 35 U.S.C. § 103(a) as unpatentable over Schilling et al. U.S. Patent 4,879,336 ("*Schilling*") in view of Maruyama et al. U.S. Patent 4,617,239 ("*Maruyama*").

## VII. ARGUMENT

The subject invention is directed to silane-modified polyvinyl alcohols which are useful, in particular, as binders in coating slips, i.e. coatings which are commonly applied to paper to produce a smooth, ink-receptive surface. Prior art hydrophobicizing binders are typified by those of *Maruyama*, the Japanese priority document of which was published in 1983. However, as indicated at the bottom of page 9 of the subject invention specification, while the claimed binders have excellent storage stability, prior art binders were deficient in this property. In the Examples, a subject invention polymer showed little viscosity increase over time (Table 3, page 13), while a prior art *Maruyama*-type polymer exhibited a severe increase in viscosity (260%! ). Appellants discovered that this increase in viscosity can be avoided by incorporating a minor amount of a 1-alkylvinyl ester into the copolymer in addition to the silane moieties. This is a highly surprising and unexpected discovery. Despite the some 19 years between the publication of *Maruyama* and the filing of the Appellants' priority application, no one had disclosed Appellants' method of increasing binder stability.

*Schilling* discloses conventional polyvinyl alcohols which are modified to contain 1-alkylvinyl ester moieties. In the Office Action of November 23, 2005, the Examiner indicated that *Schilling* teaches improved storage stability: "If applicant is referring to the improved storage stability, such *is* taught by Schilling (col. 2, lines 7-34)." However, this statement is incorrect.

The portion of *Schilling* referred to by the Examiner reads as follows:

Due to their excellent pigment-binding power and support effect for optical brighteners, two serious disadvantages of these [prior art] cobinders are accepted for industrial application. Fully-saponified polyvinyl alcohols are virtually insoluble in water at room temperature. For conversion into an aqueous solution, a polyvinyl alcohol suspension must be stirred vigorously for a relatively long time at at least 90.degree. C. which ultimately encumbers the papermaking process due to the provision of dissolving stations and additional energy costs. The second disadvantage is linked with "pigment shock". When the polyvinyl alcohol solution is added to the pigment slurry, a momentary steep increase in the viscosity of the coating slips is produced. This can only be decreased rapidly with suitable stirrers which apply very high shear forces, or by adding additional auxiliaries, the so-called "anti-shock agents".

(Col. 2, lines 7-34.)

Note that there is nothing in this section which pertains to storage stability. In the beginning of the section, the difficulties of dissolving fully hydrolyzed polyvinyl alcohols is alluded to. This low rate of dissolution has nothing to do with storage stability: polyvinyl alcohol solutions, once prepared, are very stable, as is well known to those skilled in the art. The second "disadvantage" of prior polymers which is discussed is "pigment shock," a temporary increase in viscosity upon addition of polyvinyl alcohol solution to a pigment slurry. This momentarily increased viscosity disappears of its own accord over time, and disappears more rapidly upon intensive stirring (ll. 21-23).

As can be seen, this paragraph pertains to prior art, fully hydrolyzed polyvinyl alcohol. *Schilling* improved upon the prior art products by incorporating 1-alkylvinyl esters into the copolymer. This modification of the polymer led to an improved dissolution rate, even allowing the solid polymer to be added directly to the pigment slurry (col. 3, ll. 3-7). The increased dissolution rate is illustrated in Table 2, where the Brookfield viscosity of the

copolymers, following addition to water as a solid with stirring, reached high values after only 30 minutes, while the unmodified polyvinyl alcohols did not, indicating that the latter dissolve very slowly, acting as fillers (col. 4, ll. 66-68) over this limited dissolution time.

There is no indication anywhere in *Schilling* that his copolymers are more (or less) stable than conventional polyvinyl alcohol. If the Examiner disagrees, she should point with particularity to the relevant portions of *Schilling* in the Examiner's Answer.

*Maruyama* is directed to silane-containing polyvinyl alcohols. Unlike fully hydrolyzed polyvinyl alcohols, the silane-containing polyvinyl alcohols of *Maruyama* do not have a dissolution rate problem. Note column 8, lines 18-25. Rather, these polymers apparently dissolve quickly and easily. The problem with the *Maruyama* polymers is that they contain reactive silanes which are silanol-, acetoxy-, or alkoxy-functional. *See*, col. 6, ll. 23-28. These hydrolyzable groups are reactive with water, and lead to viscosity increases and eventual gelling of the polyvinyl alcohol solution. *Maruyama*, for example, discloses siloxane bond formation by reaction of these groups, the siloxane bonds forming chain extended and crosslinked polymers, (Col. 7, ll. 61-64) and further alludes to solution instability at column 8, lines 23 - 25. This effect is also well known to the skilled artisan, and is illustrated by Example 1 and Comparative Example 1 in Table 3, where a silane-modified polyvinyl alcohol copolymer increased in viscosity (11% aqueous solution) from 25.1 mPa·s to 90.5 mPa·s in only two weeks, an increase of 260% (3.6x).

As indicated on page 9 of the application, one of the objects of the present invention was to improve the storage stability of silane-modified polyvinyl alcohols. The Examiner states that "[t]he copolymer of *Schilling* does not have a gellation problem due to the presence of the alkylvinyl acetate and would not be expected to have a gellation problem if an additional monomer such as the silane-containing monomer was further included." This is incorrect, however, for several reasons.

First, there is no evidence that the *Schilling* copolymers either have or do not have a gellation problem. *Schilling* does not mention storage stability or gellation at all. Second, *Schilling* did not solve any gellation problem, because the prior art polyvinyl alcohol copolymers had no gellation problem. There was no gellation problem to solve. Third, *Schilling* was clearly, as one skilled in the art, aware of the use of silane monomers in polyvinyl alcohol polymers. That he did not contemplate their use, but rather recited other hydrophobic monomers, strongly infers that *Schilling* was aware of the gellation problem with such silane monomers, and did not believe that such monomers would work in his copolymers.

Fourth, the Examiner's statement that 1-alkyl vinyl ester, silane-containing polyvinyl alcohol polymers "would not be expected to have a gellation problem . . ." is clear speculation and entirely unsupported, except by hindsight. The addition of hydrophobic and reactive silanes into a very hydrophilic polyvinyl alcohol copolymer would be expected to greatly change the properties of the latter. There is no way that one skilled in the art could have predicted that upon addition of silane comonomers to the polymer of *Schilling* that the silane-containing copolymer would be free from gellation. The *Maruyama* copolymer, a very similar copolymer, had gellation problems, and there is no evidence, no teaching or suggestion, that addition of a 1-alkylvinyl ester comonomer would solve this problem.

In assessing obviousness, the question presented is whether one skilled in the art would be motivated to do what Appellants have done. The standard for evidence of motivation is high, "clear and particular." *In re Dembiczak*, 175 F.3d 994 (Fed. Cir. 1999). Moreover, the problems addressed by the subject invention and the prior art are highly relevant, and a reference or combination of references which does not discuss a problem cannot suggest a solution, *In re Schaffer*, 229 F.2d 476 (CCPA 1956), and cannot render obvious an invention which does solve the problem.

The problems addressed by *Schilling* are improving the dissolution rate of polyvinyl alcohol binders and lowering pigment shock. The problem addressed by *Maruyama* is improving paper slip coatings by adding reactive, hydrophobic silane groups to a polyvinyl alcohol polymer. The reactive groups bond to the paper, rendering it hydrophobic, and decrease absorption of coating slip into the paper. (*Maruyama*, col. 9, ll. 8-25.) The problems addressed by the two references are very distinct from each other. There is no evidence of any motivation to combine.

The problems addressed by Appellants are different yet. These objects are to increase abrasion resistance (p. 2, ll. 15-17 to p. 9, last paragraph) and provide storage stable copolymers (p. 9, last paragraph). *Schilling* mentions neither of these problems, and thus the skilled artisan would not be motivated to combine the teachings of *Schilling* with *Maruyama*. *Schilling* adds his comonomer for a purpose which does not present a problem for *Maruyama*: low dissolution rate.

Appellants have surprisingly and unexpectedly discovered that by the addition of 1-alkylvinyl ester comonomers to silane-containing polymers such as those of *Maruyama*, that abrasion resistance is improved, and gellation problems eliminated. Since the gellation problems are due to the reaction of the silane's hydrolyzable reactive functional groups, which Appellants' polymers also have, it is highly surprising that the mere addition of a minor quantity of an "inert" comonomer would influence gellation. Thus, even were one skilled in the art to be motivated to combine the references, the clearly surprising and unexpected results obtained render the claimed invention non-obvious. *In re Margolis*, 785 f.2d 1029 (Fed. Cir. 1986); *In re Skoll*, 523 F.2d 1392 (CCPA 1975); *In re Costello*, 480 F.2d 894 (CCPA 1973); *In re Murch*, 464 F.2d 1051 (CCPA 1972); *In re Snoddy*, 420 F.2d 381 (CCPA 1970); *In re Papesch*, 315 F.2d 381 (CCPA 1963).

Finally, as noted earlier, the very age of the references supports the patentability of the claimed subject matter. *In re Lechene*, 277 F.2d 1073, 125 USPQ 396 (CCPA 1960); *In re Adams*, 356 F.2d 1998, 148 USPQ 742 (CCPA 1966). *Maruyama* was first published in 1983 and the U.S. application issued in October of 1986. *Schilling* was published in late 1987 or early 1988. The U.S. application issued in November of 1989. Those skilled in the art were long aware of the benefits of silane-containing polyvinyl alcohol binders, and were also aware of the gellation problems. Despite this knowledge, no one prior to Appellants were able to retain *Maruyama*'s beneficial results while also preventing gellation, despite the many years between the publication of the references and the invention by Appellants *circa* 2002.

Appellants solicit reversal of the rejection of the claims under 35 U.S.C. § 103(a) over *Schilling* in view of *Maruyama*.

The fee of \$500 as applicable under the provisions of 37 C.F.R. § 41.20(b)(2) is enclosed. Please charge any additional fee or credit any overpayment in connection with this filing to our Deposit Account No. 02-3978.

Respectfully submitted,

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Enclosure - Appendices





### VIII. CLAIMS APPENDIX

1. A silane-containing polyvinyl alcohol comprising a completely hydrolyzed or partially hydrolyzed vinyl ester copolymer having a degree of hydrolysis of from 75 to 100 mol%, obtained by free radical polymerization of

- a) one or more vinyl esters of straight-chain or branched alkane carboxylic acids having 1 to 18 carbon atoms, of which an amount of from 1 to 30 mol%, based on total polymer, are one or more 1-alkylvinyl esters of  $C_{1-6}$  carboxylic acids, where the 1-alkyl groups are  $C_{1-6}$  alkyl radicals;
- b) from 0.01 to 10 mol% of one or more silane-containing, ethylenically unsaturated monomers, and
- c) optionally further comonomers copolymerizable therewith,

and hydrolysis of the polymers obtained thereby.

2. The silane-containing polyvinyl alcohol of claim 1, wherein the vinyl ester a) comprises vinyl acetate.

3. The silane-containing polyvinyl alcohol of claim 1, wherein the 1-alkylvinyl ester comprises 1-methylvinyl acetate.

4. The silane-containing polyvinyl alcohol of claim 1, having a Höppler viscosity according to DIN 53015, as 4% by weight aqueous solution of from 2 to 50 mPas.

5. The silane-containing polyvinyl alcohol of claim 1, wherein at least one silane-containing, ethylenically unsaturated monomers is selected from the group consisting of ethylenically unsaturated silicon compounds of the general formula  $R^1SiR_{0-2}^2(OR^3)_{1-3}$ , in which each  $R^1$  is independently  $CH_2=CR^4-(CH_2)_{0-1}$  or  $CH_2=CR^4CO_2(CH_2)_{1-3}$ , each  $R^2$  independently is a  $C_{1-3}$ -alkyl radical,  $C_{1-3}$ -alkoxy radical, or halogen, each  $R^3$  independently is an optionally branched, optionally substituted  $C_{1-12}$  alkyl radical or a  $C_{2-12}$  acyl radical

optionally interrupted by an ether group, and each  $R^4$  is independently H or  $CH_3$ , and a (meth)acrylamide containing silane groups of the formula  $CH_2=CR^5-CO-NR^6-R^7-SiR_m^8-(R^9)_{3-m}$ , in which  $m = 0$  to  $2$ , each  $R^5$  is independently H or a methyl group, each  $R^6$  is independently H or a  $C_{1-5}$  alkyl group, each  $R^7$  is independently a  $C_{1-5}$  alkylene group or a bivalent organic group in which the carbon chain is interrupted by an O or N atom, each  $R^8$  is independently a  $C_{1-5}$  alkyl group, and each  $R^9$  is independently a  $C_{1-40}$  alkoxy group optionally containing further heteroatoms selected from the group consisting of O, N, S, or P.

6. The silane-containing polyvinyl alcohols of claim 1, wherein said polymerization is a mass polymerization, a suspension polymerization or a polymerization in organic solvents.

7. In a coating slip wherein a polymeric binder is employed, the improvement comprising selecting as at least one polymeric binder, a silane-containing polyvinyl alcohol of claim 1.

8. In a coating slip wherein a polymeric binder is employed, the improvement comprising selecting as at least one polymeric binder, a silane-containing polyvinyl alcohol of claim 2.

9. In a coating slip wherein a polymeric binder is employed, the improvement comprising selecting as at least one polymeric binder, a silane-containing polyvinyl alcohol of claim 3.

10. In a coating slip wherein a polymeric binder is employed, the improvement comprising selecting as at least one polymeric binder, a silane-containing polyvinyl alcohol of claim 4.

11. In a coating slip wherein a polymeric binder is employed, the improvement comprising selecting as at least one polymeric binder, a silane-containing polyvinyl alcohol of claim 5.

12. A coating slip-coated substrate, comprising a substrate and the coating slip of claim 7.

13. The coating slip-coated substrate of claim 12, wherein the substrate comprises paper, plastics-coated paper, or a plastics foil.

14. The coating slip-coated substrate of claim 12, wherein the substrate is paper.

15. The coating slip-coated substrate of claim 12, wherein said coating slip-coated substrate is suitable for use in ink jet printing.